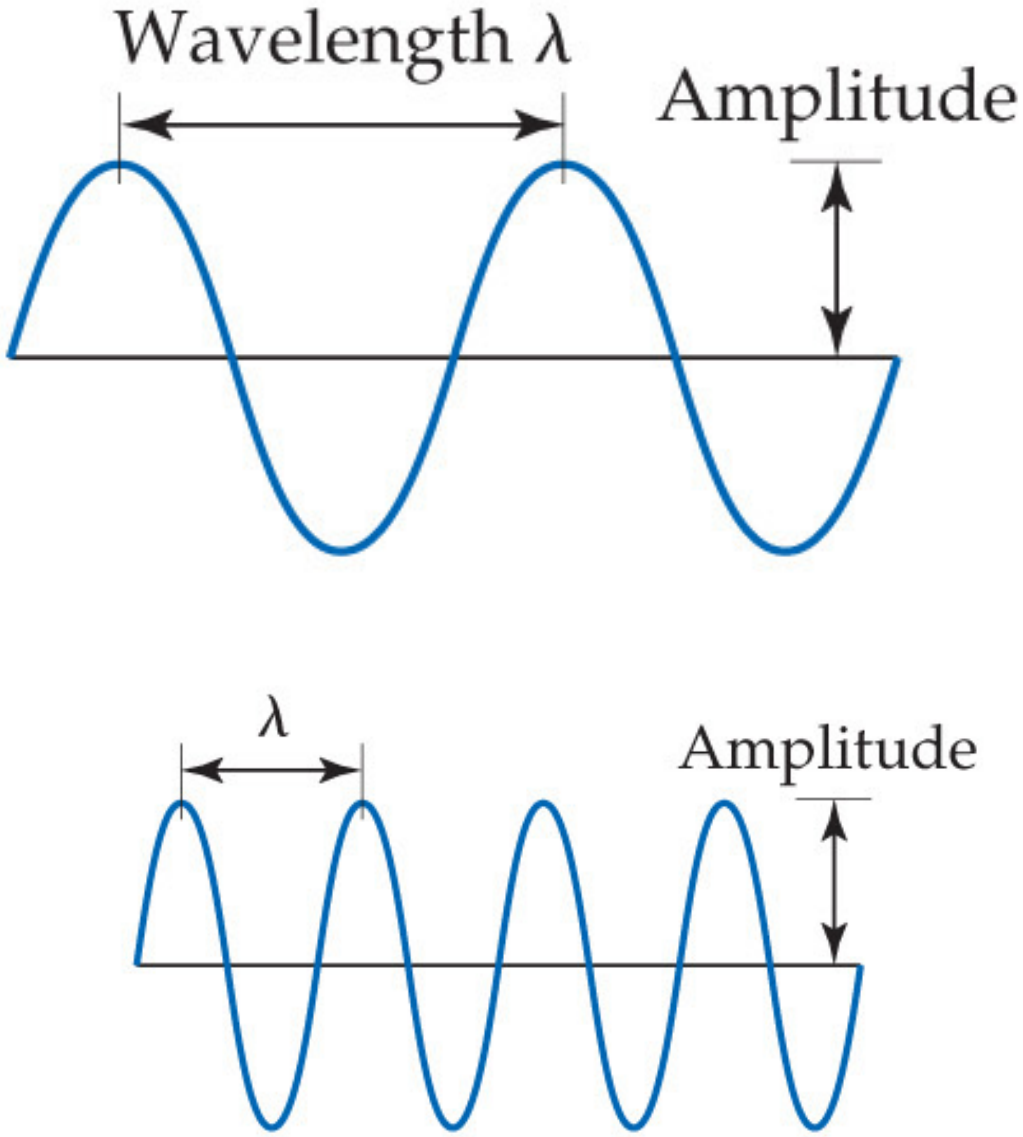
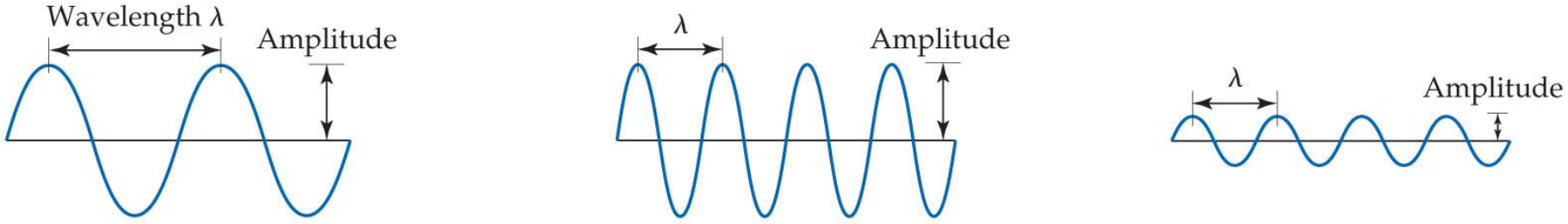

Wavelength λ
Amplitude
λ
Amplitude

Electromagnetic Radiation

- Light, *visible light*, is one type of a more general form of energy called **electromagnetic radiation.**
- Electromagnetic radiation has both properties of waves and particles.
- Wave characteristics: speed, amplitude, wavelength (λ), and frequency (ν).

$$\lambda = c/\nu \text{ , where c is } 3.00 \times 10^8 \text{ m/s}$$



(a) Two complete cycles of wavelength λ

(b) Wavelength half of that in (a); frequency twice as great as in (a)

(c) Same frequency as (b), smaller amplitude

Copyright © 2009 Pearson Prentice Hall, Inc.

Particles of Light

- Scientists in the early 20th century showed that electromagnetic radiation was composed of particles (energy packets) we call **photons.**

  Photons are massless.

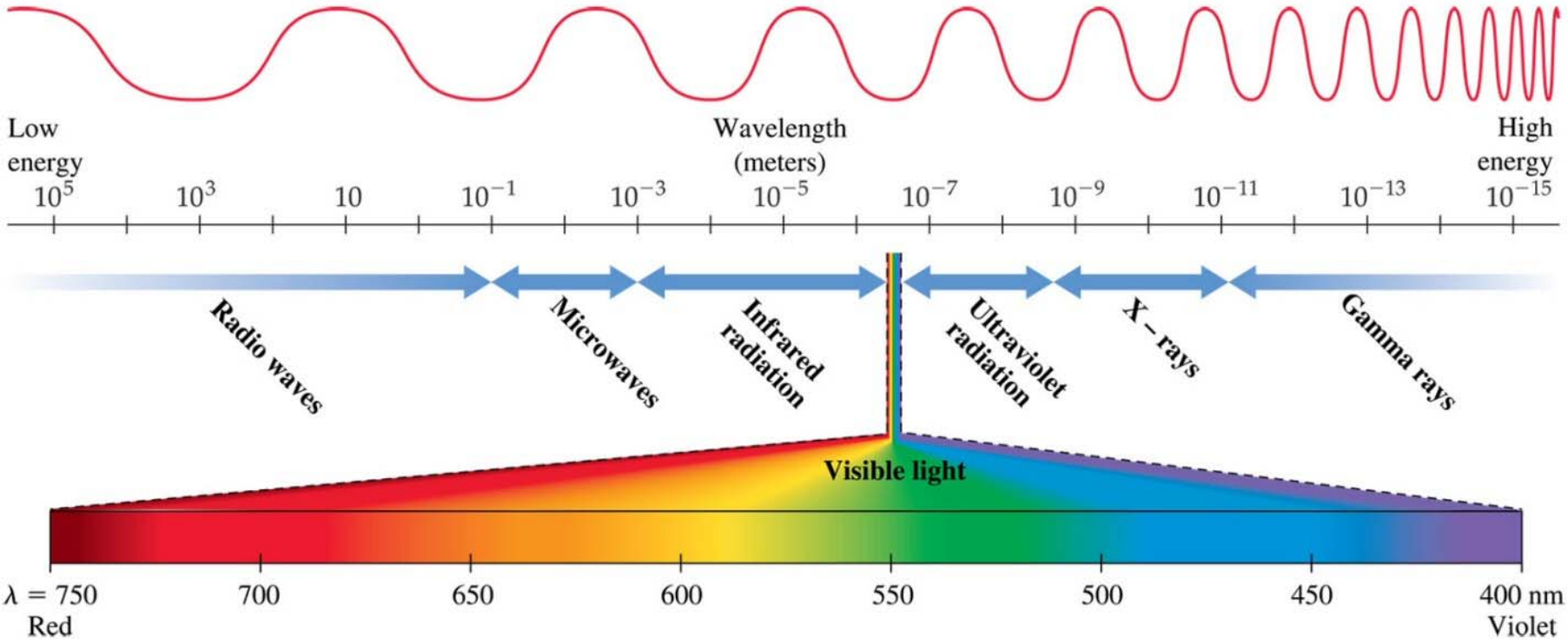
  $E_{photon} = h\nu$, where h is Plank's constant (6.626×10^{-34} J.s) and ν is the frequency of the radiation.

  $E_{photon} = hc/\lambda$

- Each wavelength of light has photons that have a different amount of energy.

  The longer the wavelength, the lower the energy of the photons.

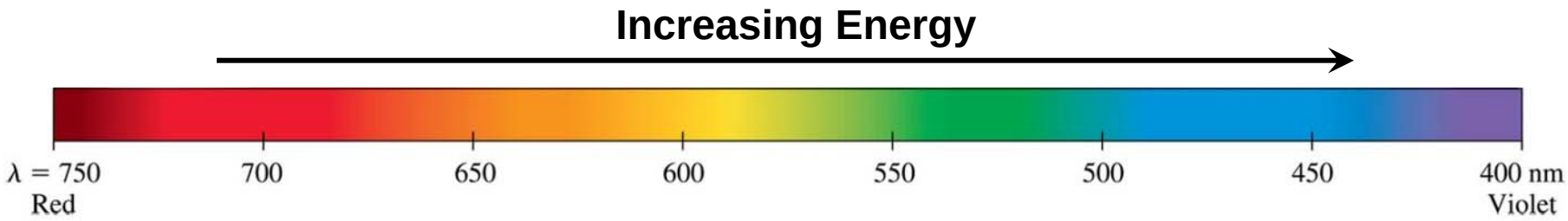
Electromagnetic Spectrum



Copyright © 2006 Pearson Prentice Hall, Inc.

R O Y G B I V

Visible Spectrum

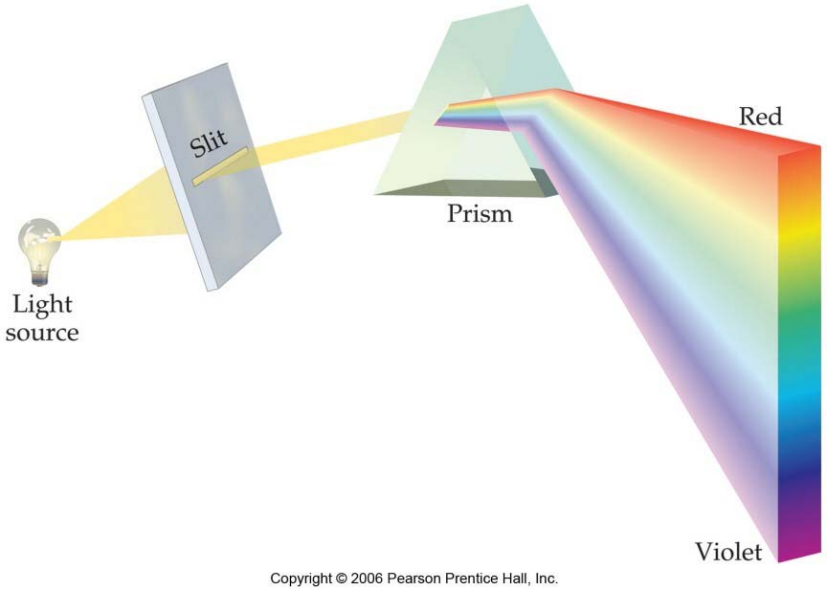


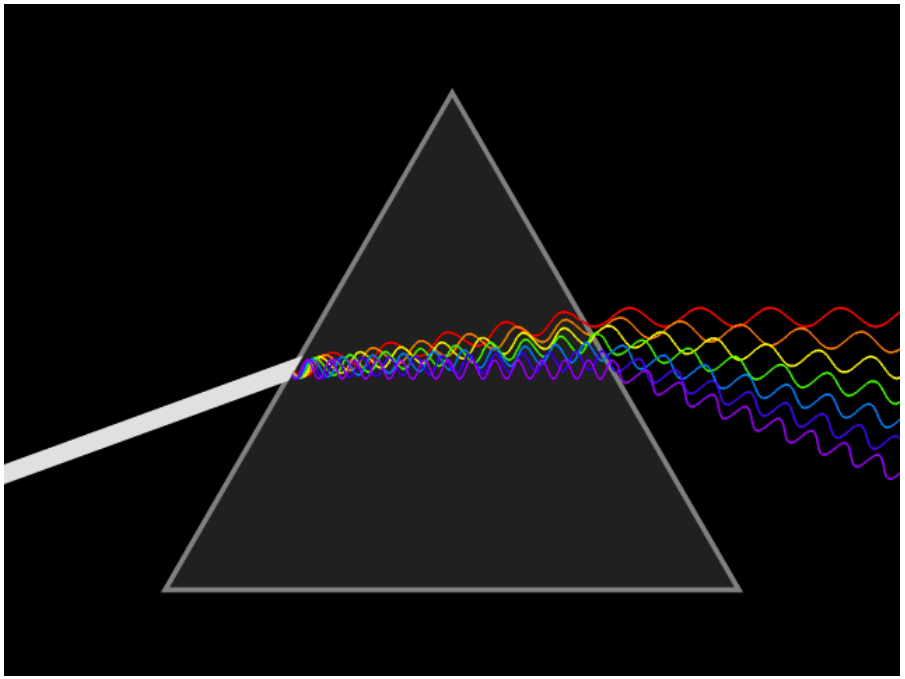
Color	Wavelength (nm)	Frequency (THz)
VIOLET	380-450	668-789
BLUE	450-495	606-668
GREEN	495-570	526-606
YELLOW	570-590	508-526
ORANGE	590-620	484-508
RED	620-750	400-484

$1nm = 10^{-9}m$ $1THz = 10^{12}Hz$

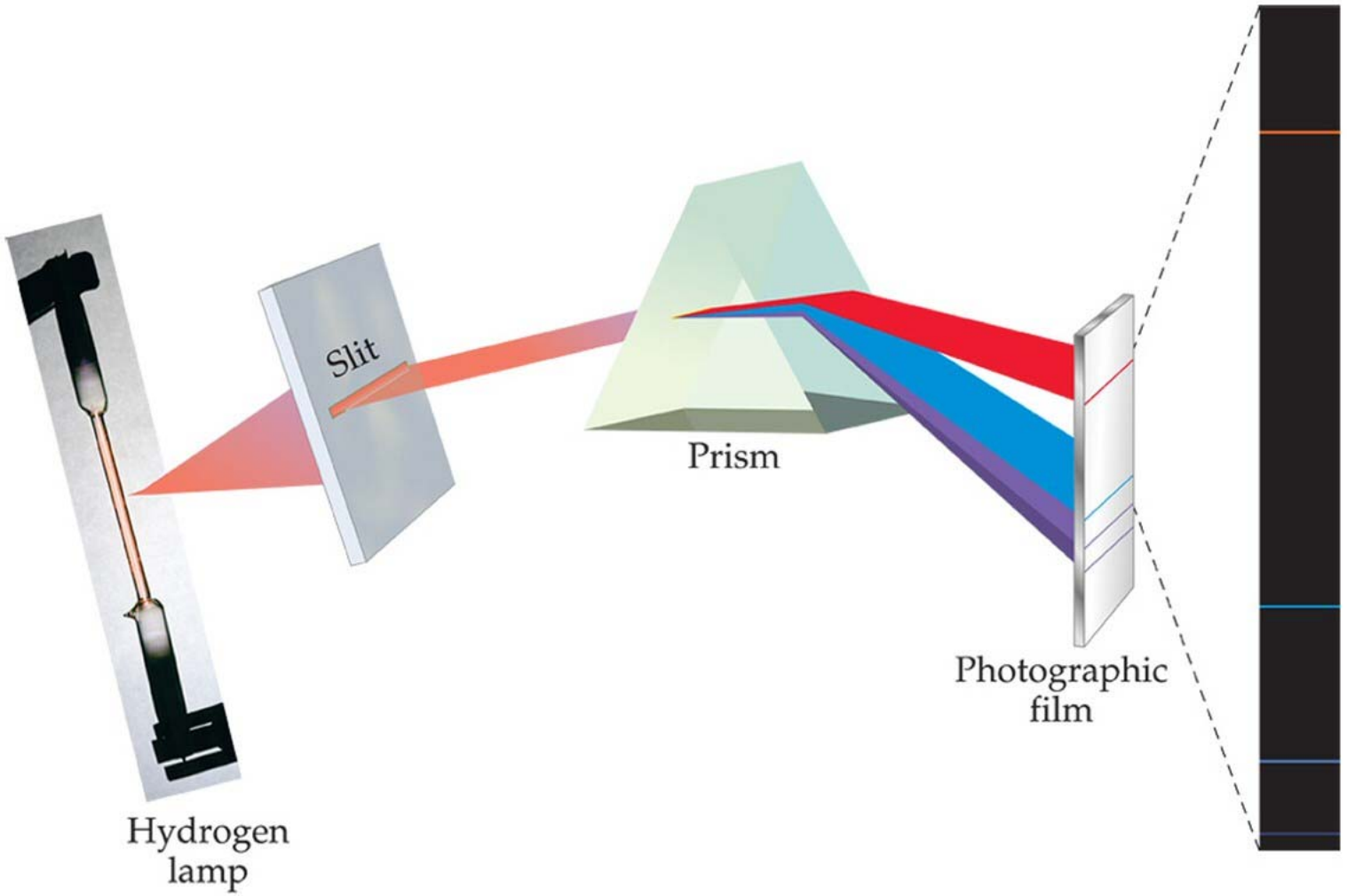
The Electromagnetic Spectrum

- White light passed through a prism is separated into all its colors - this is called a **continuous spectrum.**
- The color of the light is determined by its wavelength.





Emission Spectrum



Spectra

White light spectrum

Hydrogen light spectrum

Helium light spectrum

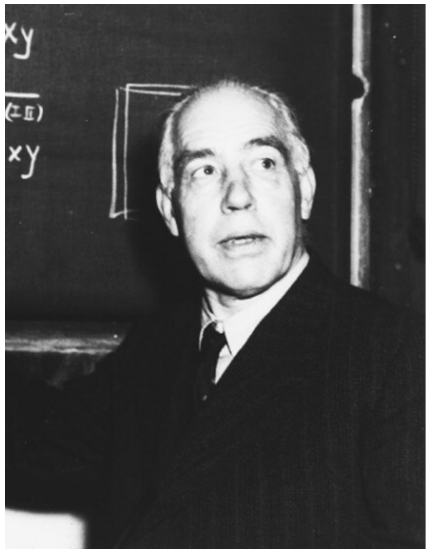
Neon light spectrum

Continuous Spectrum

Emission Lines

Absorption Lines

The Bohr Model of the Atom

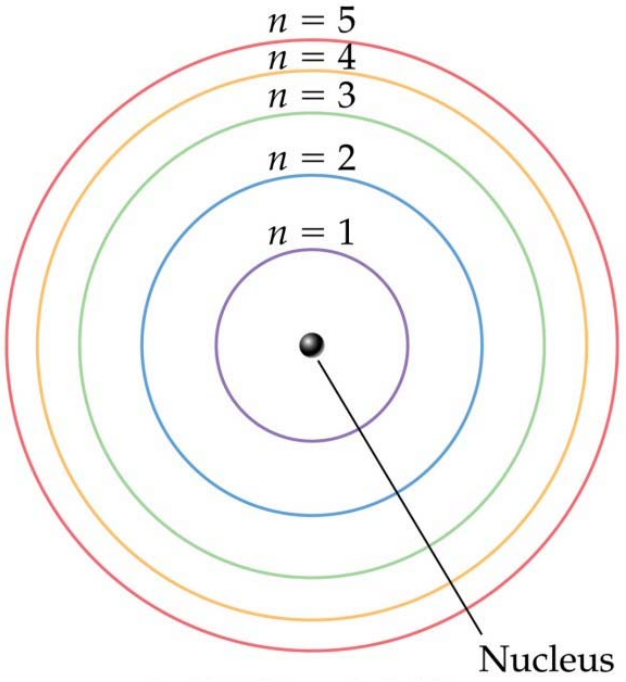


- The Nuclear Model of the atom does not explain how the atom can gain or lose energy.
- Neils Bohr developed a model of the atom to explain how the structure of the atom changes when it undergoes energy transitions.
- Bohr's major idea was that the energy of the atom was **quantized**, and that the amount of energy in the atom was related to the electron's position in the atom.

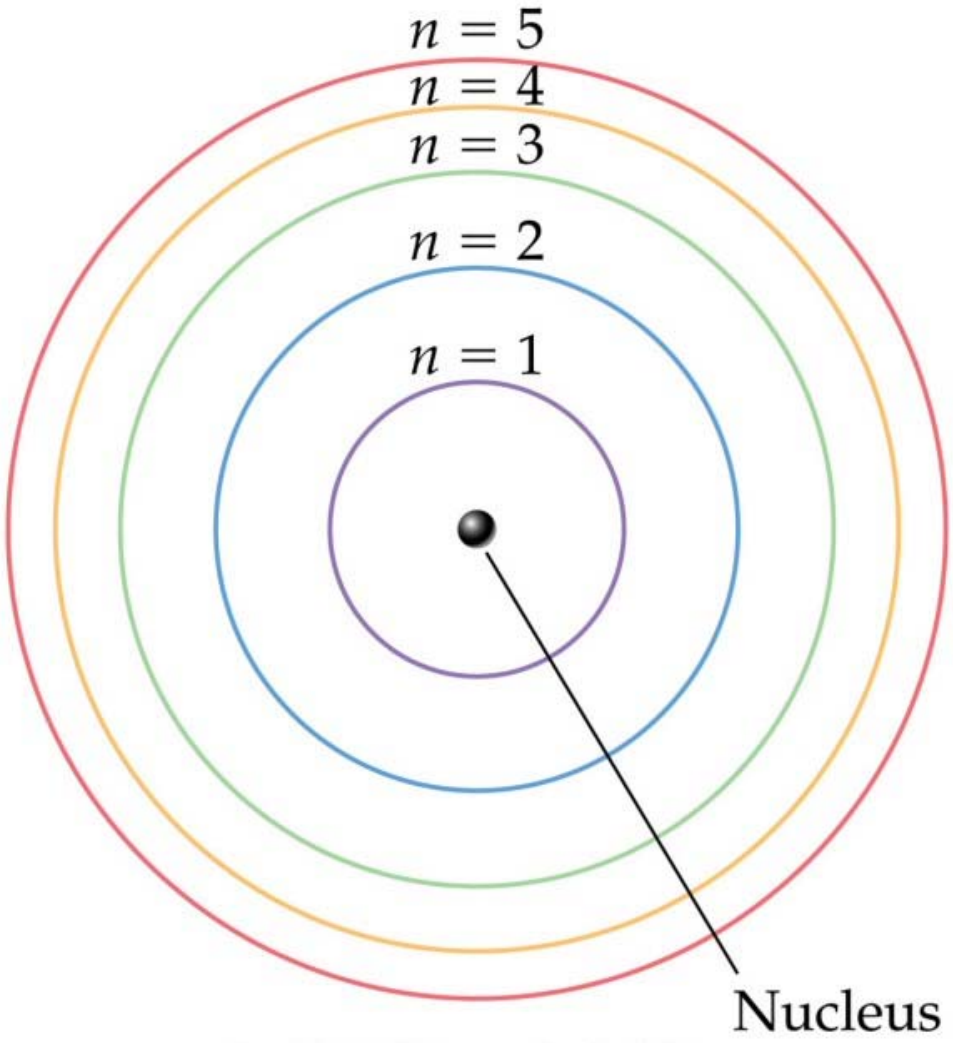
    - Quantized means that the atom could only have very specific amounts of energy.

The Bohr Model of the Atom

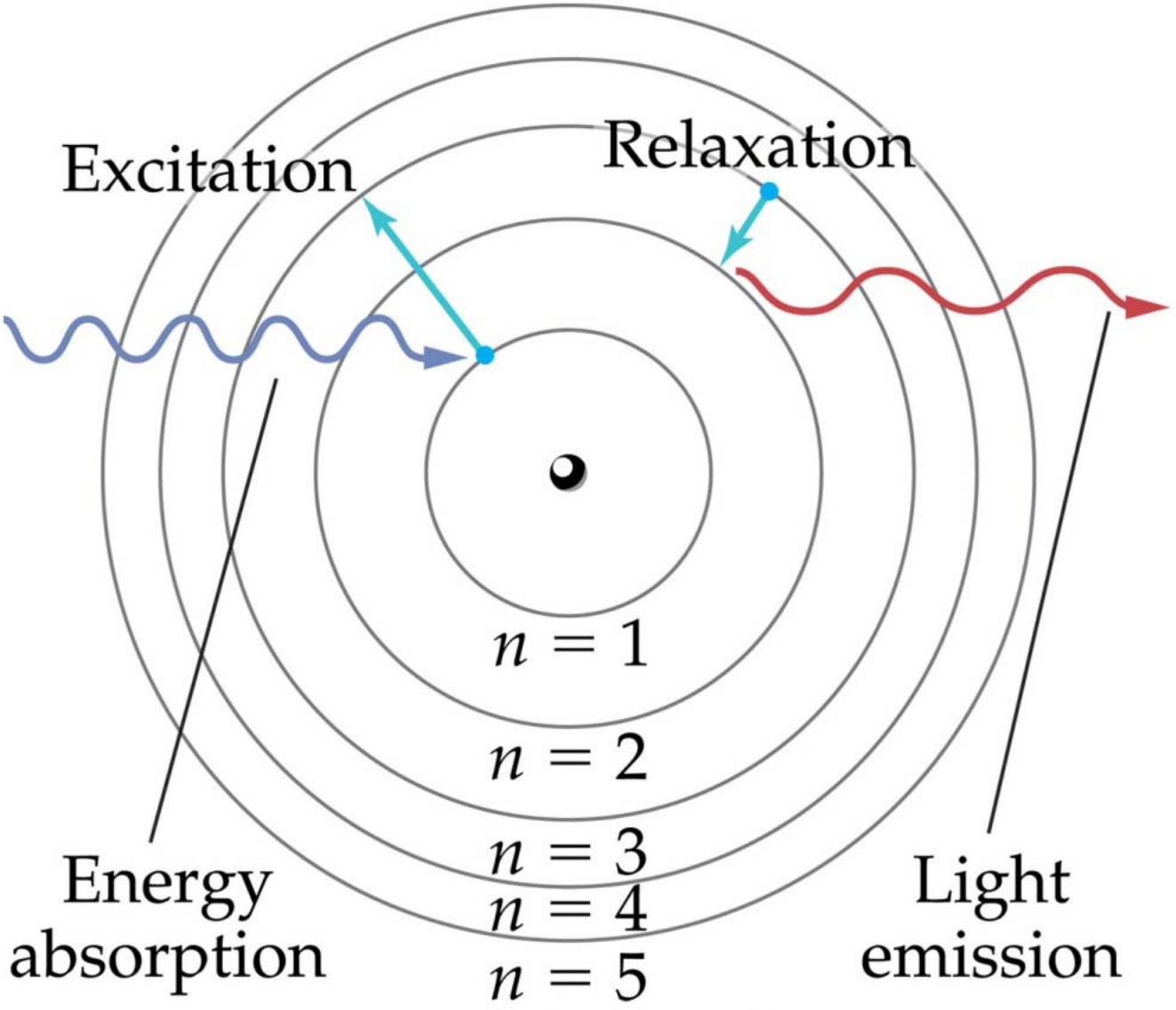
- In the Bohr Model, electrons travel in orbits around the nucleus.
  - more like shells than planet orbits
- The farther the electron is from the nucleus the more energy it has.
- The energy of each orbit is characterized by an integer - the larger the integer, the more energy an electron in that orbit has and the farther it is from the nucleus.
  - The integer, **n**, is called a **quantum number**.

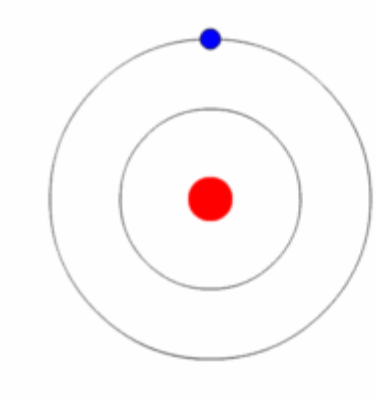


The Bohr Model of the Atom



The Bohr Model of the Atom





The Bohr Model of the Atom
Hydrogen Spectrum